REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: **409-8325**

SRP Section: **SRP 19**

Application Section: **19.1**

Date of RAI Issued: **02/22/2016**

Question No. 19-21

10 CFR 52.47(a)(27) requires that a standard design certification applicant provide a description of the design specific PRA and the results. SRP Chapter 19, Revision 3 (Draft), “Design-Specific PRA (PRA for Non-Power Modes of Operation)” states that, “Given that shutdown risk may be highly outage-specific, the staff reviews the shutdown PRA insights to confirm that operational assumptions used to develop an average shutdown model (e.g., use of nozzle dams, outage schedule, containment status, procedural requirements) have been clearly documented in the FSAR.” DCD section 19.2.2.2, "Midloop Operation" states, "Alternate inventory additions and decay heat removal methods if SCS is lost during Mode 5 reduced water inventory operations, containment spray (CS) pumps or the safety injection (SI) pumps are used to provide makeup. If all above methods of decay heat removal and inventory replenishment are unavailable, a charging pump or a boric acid makeup pump is used to provide makeup for Modes 5 and 6. If no method of pumped inventory addition is available, a source for gravity feed inventory addition can be used via the SI tanks." In Section 19.2.2.2 of the DCD, the staff requests the following information to be addressed:

a. Please justify how the safety injection tanks (SITs) can keep the core covered assuming the RCS is vented via the pressurizer given possible pressurizer surgeline flooding. Surgeline flooding following an extended loss of decay heat removal (DHR) may negate the elevation head necessary for SIT flow. Based on the shutdown evaluation report, the staff understands “With the earliest nozzle dam installation occurring at 4 days after shutdown, the decay heat present would require approximately 481 L/min (127 gpm)”.

b. Please clarify whether a charging pump and a boric acid pump are needed to keep the core covered or if either a single charging pump or a single boric acid pump is sufficient to keep the core covered. Please include the flowrate capabilities of the pumps.

Response – (Rev. 1)

a. The pressure of SITs is reduced by venting N_2 gas and maintained between 4.57 kg/cm^{2}A (65 psia) and 5.27 kg/cm^{2}A (75 psia), before the midloop operation. The slightly pressurized SITs with the elevation head can provide RCS with sufficient makeup water in spite of the head loss due to the pressurizer surge line flooding. Figure A-26, A-27 and A-28 of the Fukushima TeR (APR1400-E-P-NR-14005-P) show the core is kept covered by the makeup water from the slightly pressurized SITs during the midloop operation. It will be added in DCD section 19.2.2.2.

b. A charging pump with a makeup capacity of 150 gpm is available to provide sufficient decay heat removal capability at this time after shutdown. The boric acid makeup pump is not required and will be deleted from the discussion in the DCD.

Impact on DCD

DCD Section 19.2.2.2 will be revised as shown in Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

opened via the pressurizer manway prior to reduced-inventory operation. When the pressurizer manway is opened to the containment atmosphere, the surge line provides sufficient venting capacity to prevent RCS pressurization and preclude subsequent nozzle dam failure. The pressurizer surge line vent pathway has sufficient capacity to prevent core uncovery due to pressurization of the hot side resulting from boiling coolant.

d. Alternate inventory additions and decay heat removal methods

(flowrate capability of 150 gpm)

If SCS is lost during Mode 5 reduced water inventory operations, containment spray (CS) pumps or the safety injection (SI) pumps are used to provide makeup. If all above methods of decay heat removal and inventory replenishment are unavailable, a charging pump ~~or a boric acid makeup pump~~ is used to provide makeup for Modes 5 and 6. If no method of pumped inventory addition is available, a source for gravity feed inventory addition can be used via the SI tanks.

19.2.2.3 Station Blackout

The minimum makeup flow of 481 L/min (127 gpm) is required to keep the core covered for the loss of DHR during the mid-loop operation.

One alternate ac (AAC) source is provided to help mitigate the effects of an SBO. The AAC automatically starts and is manually aligned to provide power to a Class 1E 4.16 kV bus in case Class 1E emergency diesel generators (EDGs) fail to start and load during loss-of-offsite-power (LOOP) events. This standby unit is independent and diverse from the Class 1E EDGs. Successful startup of the AAC together with turbine-driven auxiliary feedwater pumps is sufficient to prevent core damage in station blackout events (SBOs).

19.2.2.4 Fire Protection

e. SITs can keep the core covered assuming the RCS is vented via the pressurizer for non ELAP conditions by venting N_2 gas and maintained between 4.57 kg/cm^{2}A (65 psia) and 5.27 kg/cm^{2}A (75 psia).

The systems and components required for safe shutdown are physically separated from functionally similar or redundant systems or components to maintain the ability to perform safe shutdown functions in the event of a fire. Fire protection features such as fire detection, automatic and manual fire suppression, and fixed fire barriers provide reasonable assurance that the plant does not enter an unrecoverable state as a result of a fire incident. Fire protection system is described in Subsection 9.5.1.